

1. The force required to start an object sliding across a uniform horizontal surface is larger than the force required to keep the object sliding at a constant velocity. The magnitudes of the required forces are different in these situations because the force of kinetic friction

- 1) is greater than the force of static friction
- 2) is less than the force of static friction
- 3) increases as the speed of the object relative to the surface increases
- 4) decreases as the speed of the object relative to the surface increases

2. A box is pushed toward the right across a classroom floor. The force of friction on the box is directed toward the

- 1) left
- 2) right
- 3) ceiling
- 4) floor

3. When a 12-newton horizontal force is applied to a box on a horizontal tabletop, the box remains at rest. The force of static friction acting on the box is

- 1) 0 N
- 2) between 0 N and 12 N
- 3) 12 N
- 4) greater than 12 N

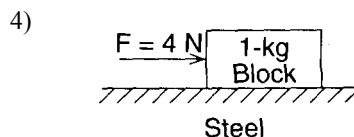
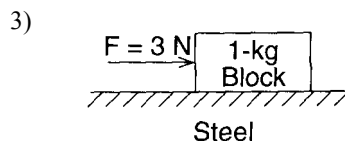
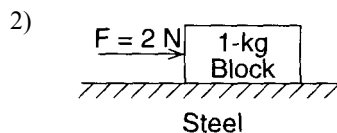
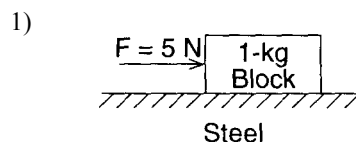
4. In the diagram below, the upward drag force acting on a parachute is equal in magnitude but opposite in direction to the weight of the parachutist and equipment.



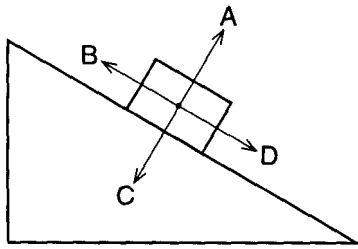
As a result of the forces shown, the parachutist may be moving

- 1) downward with decreasing speed
- 2) downward at constant speed
- 3) upward with decreasing speed
- 4) upward with constant acceleration

5. A different force is applied to each of four 1-kilogram blocks to slide them across a uniform steel surface at constant speed as shown below. In which diagram is the coefficient of friction between the block and steel *smallest*?



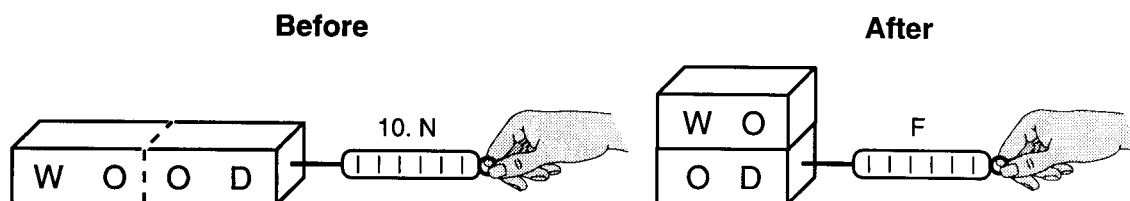
6. The diagram below represents a block sliding down an incline.



Which vector best represents the frictional force acting on the block?

- 1) *A*
 - 2) *B*
 - 3) *C*
 - 4) *D*
7. A 50.-Newton horizontal force is needed to keep an object weighing 500. Newtons moving at a constant velocity of 2.0 meters per second across a horizontal surface. The magnitude of the frictional force acting on the object is
- 1) 500. N
 - 2) 450. N
 - 3) 50. N
 - 4) 0 N
8. Sand is often placed on an icy road because the sand
- 1) decreases the coefficient of friction between the tires of a car and the road
 - 2) increases the coefficient of friction between the tires of a car and the road
 - 3) decreases the gravitational force on a car
 - 4) increases the normal force of a car on the road

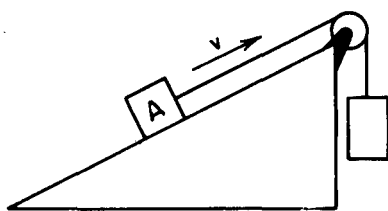
9. The diagram below shows a student applying a 10.-newton force to slide a piece of wood at constant speed across a horizontal surface. After the wood is cut in half, one piece is placed on top of the other, as shown.



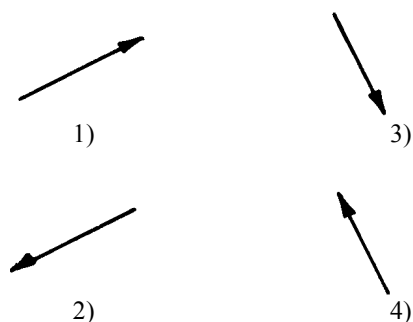
What is the magnitude of the force, F , required to slide the stacked wood at constant speed across the surface?

- 1) 40 N
- 2) 20 N
- 3) 10 N
- 4) 5.0 N

10. Block A is pulled with constant velocity up an incline as shown in the diagram below.



Which arrow best represents the direction of the force of friction acting on block A ?



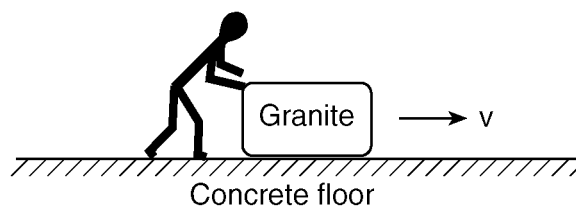
11. What is the magnitude of the force needed to keep a 60.-newton rubber block moving across level, dry asphalt in a straight line at a constant speed of 2.0 meters per second?

- 1) 40. N
- 2) 51 N
- 3) 60. N
- 4) 120 N

12. Compared to the force needed to start sliding a crate across a rough level floor, the force needed to keep it sliding once it is moving is

- 1) less
- 2) greater
- 3) the same

13. The diagram below shows a granite block being slid at constant speed across a horizontal concrete floor by a force parallel to the floor.



Which pair of quantities could be used to determine the coefficient of friction for the granite on the concrete?

- 1) mass and speed of the block
- 2) mass and normal force on the block
- 3) frictional force and speed of the block
- 4) frictional force and normal force on the block

14. The table below lists the coefficients of kinetic friction for four materials sliding over steel.

Material	Coefficient of Kinetic Friction
aluminum	0.47
brass	0.44
copper	0.36
steel	0.57

A 10.-kilogram block of each of these materials is pulled horizontally across a steel floor at constant velocity. Which block requires the *smallest* applied force to keep it moving at constant velocity?

- 1) aluminum
 - 2) brass
 - 3) copper
 - 4) steel
15. According to your reference table, *Approximate Coefficients of Friction*, what is the minimum horizontal force needed to start a 300. N steel block on a steel table in motion?
- 1) 0.57 N
 - 2) 074 N
 - 3) 171 N
 - 4) 222 N

16. As more force is applied to a steel box sliding on a steel surface, the coefficient of kinetic friction will

- 1) decrease
- 2) increase
- 3) remain the same

17. Jim wishes to push a 100. N wood crate across a wood floor. According to your table, *Approximate Coefficients of Friction*, what is the minimum horizontal force that would be required to start the crate moving?

- 1) 30. N
- 2) 42 N
- 3) 72 N
- 4) 100 N

18. According to your table, *Approximate Coefficients of Friction*, which road surface would offer the greatest traction for rubber tires?

- 1) dry concrete
- 2) wet concrete
- 3) dry asphalt
- 4) wet asphalt

Answer Key

1. 2

2. 1

3. 3

4. 2

5. 2

6. 2

7. 3

8. 2

9. 3

10. 2

11. 1

12. 1

13. 4

14. 3

15. 4

16. 3

17. 2

18. 1
